

CLAIMS

1. A microphone preamplifier, comprising
a differential input stage with a first and a second input terminal and an
output stage with an output terminal; where the microphone preamplifier is
5 integrated on a semiconductor substrate; and
a feedback circuit, with a low-pass frequency transfer function, coupled
between the output terminal and the first input terminal and integrated on the
semiconductor substrate;
where the second input terminal provides an input for a microphone signal.
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2. A microphone preamplifier according to claim 1, wherein the differential
input stage comprises an inverting input and a non-inverting input, wherein
the non-inverting input is arranged to receive the microphone signal, and the
inverting input is arranged to receive a feedback signal provided by the feed-
15 back circuit.
3. A microphone preamplifier according to claim 1 or 2, wherein the feedback
circuit is a filter with a transfer function, in the frequency domain, with a zero
and a pole; wherein the zero is located at a higher frequency than the pole.
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4. A microphone preamplifier according to any of claims 1 to 3, wherein the
preamplifier has a transfer function, in the frequency domain, with a zero and
a pole; wherein the pole is located in the range 0.1Hz to 50 Hz or 0.1Hz to
100Hz or 0.1 to 200Hz.
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5. A microphone preamplifier according to any of claims 1 to 4, wherein the
feedback circuit is a filter which, in the frequency domain, has a relatively
high gain level below a transition frequency range and a relatively low gain
level above the transition frequency range.
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6. A microphone preamplifier according to claim 5, wherein the transition frequency range is located below a frequency of about 100 Hz.
7. A microphone preamplifier according to claim 5, wherein the transition
5 frequency range is located below a frequency of 40 Hz.
8. A microphone preamplifier according to any of claims 1 to 7, wherein the feedback circuit is an active filter.
- 10 9. A microphone preamplifier according to any of claims 1 to 7, wherein the feedback circuit is a passive filter.
- 15 10. A microphone preamplifier according to any of claims 1 to 9, wherein the feedback circuit is configured with an active device which provides an ohmic impedance across a two-port circuit.
- 20 10. A microphone preamplifier according to any of claims 1 to 11, wherein the feedback circuit comprises a configuration with a first and a second active device and a current source, where the devices comprise a respective gate terminal, a source terminal and a drain terminal, and where the gate terminals are interconnected at a node connected to the current source and the drain terminal of the first device, and where the source terminals are interconnected, to provide the second device in a state where an ohmic resistance is provided between its drain and source terminal.
- 25 11. A microphone preamplifier according to any of claims 1 to 12, wherein the feedback circuit comprises a filter with an input port connected to a series connection of a first and second resistor which forms a resistor node at their interconnection, and connected to a series connection of a first and second capacitor which forms a capacitor node at their interconnection; and an output port at the capacitor node; wherein the resistor node and capacitor

node are interconnected by an active device which provides an ohmic impedance across a two-port circuit.

12. A microphone preamplifier according to any of claims 1 to 11, wherein the feedback circuit comprises a source providing a DC offset.
13. A microphone preamplifier according to any of claims 1 to 12, wherein the feedback circuit comprises a filter with a source that provides a DC offset.
- 10 14. A microphone preamplifier according to any of claims 1 to 13, wherein a DC offset is provided at the first input of the preamplifier by a circuit configuration comprising a current source coupled, at the circuit node of the first input of the preamplifier, to an active device which provides an ohmic impedance across a two-port circuit.
- 15 15. A microphone preamplifier according to claim 14, wherein the active device constitutes a second device in a configuration with a first and the second active device and a current source, where the devices comprise a respective gate terminal, a source terminal and a drain terminal, and where the gate terminals are interconnected at a node connected to the current source and the drain terminal of the first device, and where the source terminals are interconnected, to provide the second device in a state where an ohmic resistance is provided between its drain and source terminal.
- 20 25 16. A microphone preamplifier according to claim 1, wherein the differential input stage comprises a first and second current path for the respective differential inputs, and wherein a DC offset is provided by establishing different DC currents through the first and second current path of the differential input stage.

17. A microphone preamplifier according to any of claims 1 to 16, wherein the preamplifier is configured to receive the microphone signal via an input bias element which has relatively high ohmic impedance when the microphone signal is relatively small in magnitude and relatively low ohmic impedance
5 when the microphone signal is relatively high in magnitude.
18. A microphone preamplifier according to claim 17, wherein the bias element is configured by two cross-coupled diodes.
- 10 19. A microphone preamplifier according to claim 17, wherein the bias element is configured by two cross-coupled bipolar transistors.
- 15 20. A microphone preamplifier according to claim 17, wherein the bias element is configured by two cross-coupled Metal Oxide Semiconductor, MOS, devices.
- 20 21. A microphone preamplifier according to any of claims 1 to 20, wherein the preamplifier is a differential amplifier which is configured to convert an input signal into a common mode signal for low frequencies and into a differential signal for audio frequencies.
- 25 22. A microphone preamplifier according to any of claims 1 to 21, wherein a differential amplifier is configured as an instrumentation type amplifier with two inputs and a first and a second output, wherein the first and second input is arranged to receive a microphone signal, but wherein the inputs are coupled to receive the microphone signals substantially in phase at relatively low frequencies and substantially out of phase at relatively high frequencies.
- 30 23. A microphone preamplifier according to any of claims 1 to 22, wherein a differential amplifier is configured to provide frequencies below an audio band

as common mode signals and audio band signals as differential mode signals.

24. A microphone preamplifier according to any of claims 1 to 23, wherein a
5 phase shifter is coupled between inputs of the differential amplifier.

25. A microphone preamplifier according to any of claims 1 to 24, wherein a
phase shifter is cross coupled between an output of one side of the
differential amplifier and an input of the opposite side of the differential
10 amplifier.

26. A microphone preamplifier according to any of claims 21 to 25, wherein a
phase shifter is coupled between a signal node, substantially in phase with
an input signal to the amplifier, and an input terminal of an opposite side of
15 the differential amplifier.

27. A microphone according to any of claims 1 to 26, comprising
a voltage pump integrated on the semiconductor substrate.
20 28. A microphone according to any of claims 1 to 27, comprising an electret
microphone configured to provide a microphone signal, responsive to a
sound pressure on the electret microphone, to the microphone preamplifier.

25 29. A microphone module according to any of claims 1 to 28, wherein the
electret microphone is mounted inside a space formed by a cartridge, and
wherein the microphone preamplifier is integrated within the microphone
module.

30 30. A microphone preamplifier according to any of claims 1 to 29, comprising
a MEMS microphone member to provide a microphone signal, responsive to
a sound pressure on the MEMS microphone, to the microphone preamplifier.

31. A microphone preamplifier according to claim 29, wherein the MEMS microphone member and the microphone preamplifier are integrated on a semiconductor substrate.